

# Development of a Predictive Model for Mild Cognitive Impairment in Parkinson's Disease with Normal Cognition Using Kernel-based C5.0

## Machine Learning Blending: preliminary research

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### Objectives

This preliminary study mainly compared the performance for predicting PDMCI between single machine learning and hybrid machine learning. We will develop interpretable machine learning using C5.0 in a follow-up study based on the results of this study.

### Methods

✓ **Data source** : Parkinson's Disease Epidemiologic (PED) Data after receiving an approval (No. KBN-2019-1327) from the Distribution Committee and an approval (No. KBN-2019-005) from the Research Ethics Review Committee of the National Biobank of Korea.

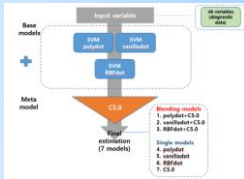
✓ **Subjects** : 185 patients with Parkinson's disease (75 Parkinson's disease patients with normal cognition, and 110 patients with PDMCI)

✓ **Measurement**

■ **Dependent variable** : "with PDMCI" and "with normal cognition" according to the diagnosis of the neurologist

■ **Explanatory variables** : 48 variables (diagnostic data), including motor symptoms of Parkinson's disease, non-motor symptoms of Parkinson's disease, and sleep disorders, as explanatory variables.

✓ **Development of prediction model**: In this study, a PDMCI prediction model was developed using the blending approach (base model = SVM; meta model = C5.0).



### Results

The results of this study showed that the RBFdot+C5.0 was the model with the best performance to predict PDMCI in Parkinson's disease patients with normal cognition (AUC=0.88) among the seven machine learning models.

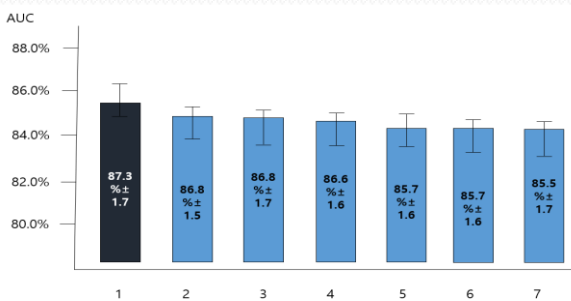


Fig. 1. The comparison of AUC for seven machine learning models

1= RBFdot+C5.0; 2= polydot+C5.0; 3= vanilladot+C5.0; 4= RBFdot+C5.0; 5= C5.0; 6= vanilladot; 7= polydot

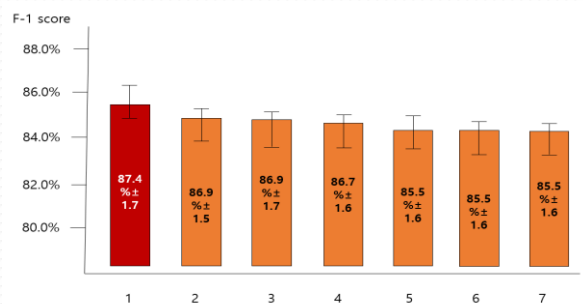


Fig. 2. The comparison of F-1 score for seven machine learning models

1= RBFdot+C5.0; 2= polydot+C5.0; 3= vanilladot+C5.0; 4= RBFdot+C5.0; 5= C5.0; 6= vanilladot; 7= polydot

### Conclusion

✓ The results of this study showed that the RBFdot+C5.0 was the model with the best performance to predict PDMCI in Parkinson's disease patients with normal cognition (AUC=0.88) among the seven machine learning models.

✓ It is necessary to develop a cus-tomized screening program for detecting PDMCI in Parkinson's disease patients with normal cognition early based on the results of this study.